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EX PARTE OR LATE FILED

December 4, 2000

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

EX PARTE OR LATE FILED

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: *Ex Parte* Filing of Sirius Satellite Radio Inc. in ET Docket No. 98-42

Dear Ms. Salas:

On behalf of Sirius Satellite Radio Inc. ("Sirius"), and pursuant to Part 1.1206 of the Commission's Rules, we hereby submit a copy of the responses that Sirius and XM Radio Inc. ("XM Radio") provided to a series of technical questions posed by Fusion Lighting, Inc. ("Fusion"). The responses of Sirius and XM Radio to these questions are part of a technical dialogue between Fusion and satellite digital audio radio service ("satellite DARS") licensees Sirius and XM Radio whose purpose is to determine potential interference from Fusion's RF lighting devices to satellite DARS systems operating in the 2320-2345 MHz band.

Sincerely,

John F. Papandrea

Carl R. Frank
John F. Papandrea
Counsel to Sirius Satellite Radio

Enclosure: Sirius/XM Responses to Questions from Fusion Lighting, Inc.

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No. of Copies rec'd 0+1
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Attached Certificate of Service

Sirius/AM Responses to Questions from Fusion Lighting, Inc.
Filed at the Federal Communications Commission on December 4, 2000

QUESTIONS FOR XM AND SIRIUS

1. Has XM or Sirius conducted any in-band noise surveys? How was the data taken? What data is available?

   ANSWER: XM and Sirius have surveyed and continue to survey the free space electromagnetic environment within the US. Data is taken with calibrated receivers and preliminary data is very positive in terms of interferers. In general the data has indicated that the noise levels outside the dense urban areas (i.e. outside the zones in which SDARS licensees will install terrestrial repeaters) are consistent with the satellite link budgets and the expected thermal noise levels. The data shows no existing problems in the band and we are preparing a report of the findings. Does Fusion have any studies which they have performed which could provide additional data?

2. Have any field tests been conducted to determine the sensitivity of DARS receivers to microwave oven emissions?

   ANSWER: Yes, we have previously conducted tests of susceptibility of DARS receivers to microwave oven emissions, as a function of separation distances between them. We've studied the issue generally and reviewed NTIA data and reports. Our results to date indicate that microwave ovens produce emissions much lower than the Fusion lamps measured to date and are mainly indoor emissions with significant structure attenuation. We do not predict significant interference with the anticipated separation distances. Our recently completed survey's produced no indications of interference from microwave oven sources.

3. Have tests been conducted at the DOE or any other installation of Fusion lamps?

   ANSWER: We have taken a survey of the Fusion Lighting installation at the Department of Energy Courtyard overhang at the west end of L'enfant Plaza. We presented preliminary test data at the Joint XM-Sirius-Fusion meeting at the FCC on 10/16/2000. The data was taken using a calibrated receiving set-up, utilizing amplification and bandpass filtering to examine emissions from the Fusion Lighting

installation. There was significant OOB emissions in the DARS band at the nominal 25 foot separation distance expected between rooftop DARS antenna and the lamps. Our results showed significant RF radiation within the satellite DARS band that we assess to be generated by the Fusion lamp RF exciter. Subsequently, you have advised that the DOE installation is atypical—it employs a switching power supply that reduces unwanted RF emissions but is of a type Fusion does *not* currently expect to sell to the public. This suggests that more typical Fusion light installations will generate significantly greater interference in the satellite DARS band than that measured at DOE. We hope that our recent joint testing project will better establish the level of interfering emissions in the satellite DARS band produced by the Fusion lighting devices.

4. How does one test for lamp/receiver compatibility?

   ANSWER: By measuring the amount of RF energy present within the DARS receiver passband caused by the RF Lighting devices, and comparing this level to established signal operating levels for DARS reception, one can calculate the amount of signal to noise degradation to be expected from the interfering signal.

5. What can be done to harden the DARS receivers from lamp or other emissions?

   ANSWER: We have extensively protected the DARS receivers from strong out of band emissions. Each receiver uses bandpass filtering in the first amplifier stage which significantly attenuates OOB emissions. In addition, this amplifier has a very wide dynamic range and high Third Order Intercept point. There is no additional mechanism to further improve the satellite link margin, and nothing we can do to limit OOB emissions that fall within our band. We have done as much as possible with our operational low signal to noise (C/N) ratios.

6. Why can't XM and Sirius accept the same noise limits as all other licensed services?

   ANSWER: Our operational noise levels are appropriate for mobile satellite services. There is a big difference between designing mobile

systems which operate via satellite delivery and terrestrial based mobile systems. This is due to the low signal to noise ratios any mobile satellite based broadcast system, such as ours, operates at.

The satellites employed by each company are the most powerful available and are used exclusively for transmitting our SDARS signal. These satellites (2 in orbit in the case of XM; 3 in orbit in the case of Sirius) have already been procured. All of the Sirius satellites are already in-orbit. In addition, our systems use a relatively wide channel bandwidth to deliver 100 channels of radio to our subscribers (approx. 2 MHz for XM, 4 MHz for Sirius).

7. Is receiver sensitivity a function of the DARS protocols used? The number of CD-quality or other channels provided? How might future changes in DARS protocols or an increase in channel density impact receiver sensitivity or reception in the context of lighting emissions?

ANSWER: Receiver sensitivity is set by the designs of the DARS systems for our licensed service offerings. The approximate link budgets for each system has been on file at the FCC for years, and the FCC licensed each system having more particular design and link information in the record. Because, as noted above, the satellites have been procured, and in Sirius Satellite Radio's case launched, the system design (including protocols and receiver sensitivity) can no longer be altered.

In any event, both systems utilize state-of-the-art audio coding techniques to minimize the data rate per audio channel while maintaining excellent quality and fidelity. The audio data is protected with powerful channel coding which occupies a significant portion of the aggregate transmitted data rate. XM uses TDM; the data stream is set and each channel has a time slot. It is not a CDMA system. Sirius' system is Time Division Multiplexed as well. No changes are expected to the system architectures which will alter receiver sensitivity. Sirius currently has two orbiting satellites operating with their designed architecture and protocol. Both SDARS providers have prototype receivers.

8. How does spectral power density relate to measured field strength in terms of receiver sensitivity?

ANSWER: Simply speaking, SDARS receiver sensitivity is determined by thermal noise, receiver bandwidth, internally generated receiver noise (i.e. noise figure) and the required signal to noise ratio (Eb/No) for acceptable BER performance. Loss of signal or increase in noise degrades the link. Wide-band interference (I), such as that generated by RF Lighting, can elevate the noise floor and "desense" the receiver. Interference analysis in satellite systems is typically expressed in terms of the increase of the wanted signals noise temperature due to the interfering signal. The interference to wanted signal noise density ratio (I/N) needs to remain below about 6% (i.e. I/N of −12.2 dB) to avoid coordination.

Measurement of the interfering field strength allows the conversion to the equivalent power of an isotropic radiator (EIRP) that would generate such interference. With appropriate free space path loss assumptions at this frequency (i.e. ~ 60dB @ 10m, ~50dB @ 3m), and antenna information, the interference power incident on the victim receiver can be determined.[1]

9. Why is RF lighting singled out as a special interference case?

ANSWER: We are not signaling out any special cases. We are simply looking at the strong probability that an unlicensed product will produce out-of-band emissions strong enough to undermine a licensed service. RF lighting use of its band, not to mention the DARS band, is SECONDARY to licensed uses. Therefore, we want to make sure that Fusion designs its product consistent with the Communications Act and the FCC's regulations, i.e., does not interfere with DARS.

This is particularly true for RF lighting, because the RF interference is a by-product of the photonic process used to create the light. The out of band energy is not utilized by the primary process.

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[1] $E^2 = 377 * P$ where E = rms field strength in volts/meter, P= the power flux density in watts/meter^2 and 377 ohms is the impedance of free space. Power spectral density over 1 MHz is obtained by measuring the field strength in a 1 MHz band.

In addition, RF lighting is the only service which we know of to date with the potential for extremely unfavorable geometry into satellite DARS receivers. This is because, as Fusion admits, RF lighting is extremely likely to be employed in street lamps, which will emit energy directly from overhead into our roof-mounted antennas.

10. Is there any known commercial spectra that is quiet to the level of 1.8uV/m @ 30 meters?

ANSWER: Yes. The Commission specifically adopted an out-of-band emission standard for the WCS service that requires attenuation in the DARS band below this level.

CERTIFICATE OF SERVICE

I hereby certify that on this 6th day of December, 2000, I caused copies of the foregoing ***Ex Parte*** **Filing of Sirius Satellite Radio Inc. in ET Docket No. 98-42** to be mailed via first-class postage prepaid mail to the following:

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